How'd You Simulate That?

By LCdr. Jim Ridgway and LCdr. Scott Bailey

Annual pilot-NATOPS checks in the mighty Orion are a constant barrage of simulated malfunctions, mixed liberally with NATOPS-knowledge questions. Throughout, we are expected to proficiently operate the aircraft, while "driving" the scenario with the rest of the flight to make sure our CRM skills are up to snuff.

We were close to home field, doing the high work for my annual check and also a fly 5 for the training-flight engineer (TFE). The flight was going smoothly as we shut down the No. 1 engine after a simulated fire. We were discussing the shutdown with the TFE when the instructor-flight engineer (IFE), who was standing behind the TFE, called out "prop-pump light No. 4."

Between the time he said that and the time I looked over at the No. 4 engine indications—approximately two seconds—prop-pump lights No. 1 and No. 2 illuminated, and the propeller was overspeeding at 105.5 percent. The overspeed slowly increased to 106 percent and stabilized. This situation meant the variable-pitch blades had pitchlocked at the value they were in when the controlling hydraulic fluid departed the propeller system.

Propeller malfunctions are the bane of the P-3 community. Every ditch in the history of the P-3 resulted from a propeller malfunction. Propeller procedures have changed over the years to reflect lessons learned from these incidents. NATOPS procedures deal extensively with all aspects of propeller malfunctions, but, for all that emphasis, this type of malfunction still is rare. When a propeller malfunctions, it gets everyone's attention. None of our crew—with over 20 years of combined P-3 flight experience—had seen a pitchlock before this flight.

The IFE quickly got the training-flight engineer out of the seat. At the same time, the IP (in the right seat) turned off the No. 4 generator switch, in case the propeller overspeed exceeded the generator's limits of 109 percent. The IFE hurried through the prop-overspeed procedures from memory.

One thing we don't need in the P-3 is fast hands in the cockpit. Because the situation appeared to be stable, I told the IFE to slow down and that we would go through the NATOPS steps. The engine and prop had stabilized, and the pitchlock mechanism was doing its job. While it's important to be thoroughly familiar with the emergency procedure, it is not necessary to hurry through the procedure when the engine is stable, with no indications of impending structural failure.

After completing a normal restart on the No. 1 engine and reviewing the procedures, we checked with the aft observer and confirmed what we already had suspected. Something in the hydraulic system that controlled the propeller, had given way, causing the loss of all controlling hydraulic fluid to the No. 4 propeller. We completed the operation-with-a-pitchlocked-propeller procedure and talked about our next course of action.

We were close to home plate and at 6,000 feet. Between home and us was a solid cloud deck from 4,000 to 1,700 feet. Since this was Brunswick in January, we were certain to encounter icing on descent through the clouds. We decided to complete the checklists and to brief the engine-out considerations while VFR above the clouds—to avoid lengthy discussions during the busy descent to approach. One of the last steps in the operation with a pitchlocked-propeller procedure is to fuel-chop the engine. Because we did not want to deal with control problems at a low altitude, and we were close to home plate, we decided to fuel-chop above the

Photo by Matthew Thomas

cloud deck, then make our approach and land. We had been working within our VFR-altitude block and had not told approach of our troubles; we still had our hands full with taking care of the emergency. We decided to stabilize the aircraft after fuel-chop and then to declare the emergency with approach.

Three things can happen following fuel chop:

1. The propeller can go to a stabilized negative-torque sensing (NTS) condition. This condition would provide some controlling fluid in the prop dome, and we then could pull the emergency-shutdown handle and feather the prop. This is the best-possible scenario and commonly is referred to as "the good."

2. The propeller can decouple from the engine, causing the propeller to spin somewhat freely in the airstream. This condition causes only minor control problems on approach and landing; it's commonly referred to as "the bad."

3. The propeller can windmill but remain coupled with the power section. A great deal of drag occurs as the airflow spins the giant fan and turns the motor. This condition creates the greatest control problems for the pilots but

gradually gets easier as the airplane slows on approach and landing. This worst-case scenario commonly is referred to as "the ugly."

I slowed the aircraft to increase shaft horsepower before the fuel-chop—mindful to keep our rpm above 95 percent to prevent flameout. At approximately 150 knots, with approach flaps and indicating just over 2,000 shp (up from 1,000 shp after the pitchlock), we had the FE fuel-chop No. 4.

As soon as the FE fuel-chopped the engine, we could see the rpm drop. It stabilized at 60 percent, with shaft horsepower negative 700. An initial yaw of the aircraft occurred at fuel-chop, but the plane was very controllable, and, after a moment, the yaw seemed to decrease slightly. The shaft-horsepower needle for the No. 4 engine began to wander, and we wondered if the propeller had decoupled. Because none of us ever had seen a real decouple, it was a good question. We had followed our NATOPS procedures, and the result was a pitchlocked propeller, decoupled—not the best situation but certainly not the worst. We completed the emergency-shutdown checklist, made our call to approach (declaring the emergency), and set-up for the approach through the cloud layer to home field.

We had prepared for the call to approach; the message was straightforward, and no time was wasted explaining things to the controllers. We told them what we needed and gave them all the information they needed. The crew had time to concentrate on the approach as we descended through the clouds.

We initially asked for and received clearance for a PAR to runway 1R at NAS Brunswick. But, as we descended through 2,000 feet, we were clear of the clouds, and we changed our request to a visual approach. A visual would give us better control of the situation, without worrying about the extra radio calls involved with the PAR. The aircraft was handling well, and a slow-flight check in the approach configuration showed no difficulties.

The approach to landing was unusual because what would be considered normal power corrections for speed and rate of descent were insufficient because of the increased drag—courtesy of our windmilling prop. A power reduction normally would produce an airspeed correction of 5 knots but wound up producing a 15-knot change. The entire approach, therefore, required significantly more power over what is considered normal. Touchdown and landing were not much different from any other three-engine landing. As we slowed on the runway, the No. 4 prop rpm decreased, and, when we left the runway to taxi to the line, the prop stopped turning. It was dripping more prop fluid than we ever wanted to see on a nacelle.

The entire experience lasted 30 minutes. What had been a vague and almost frightening section of NATOPS became something we found easy to handle with good CRM and NATOPS knowledge. I suppose the worst part (or the best part, depending on how you look at it) of propeller malfunctions is they do not occur often, and our experience at handling them often is very low. Even with this lack of real-life experience, our procedures worked perfectly. We knew what to expect, and we learned we always had been ready to handle something of this nature.

Prop malfunctions have caused some of the worst mishaps in the P-3 community. Our NATOPS covers every conceivable contingency, and, because of the experiences of those who have gone before, we were ready to handle our emergency. ✈

LCdrs. Ridgway and Bailey fly with VP-92.